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THE WARNING SIGNS OF MASTITIS — ANALYZING A COMBINATION OF FACTORS TO DECIDE WHEN TO TREAT

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Looking for one change in a cow's udder health status may not give you enough of a warning that something is wrong. You might miss the opportunity to treat a mastitis infection early to avoid further losses. By analyzing a combination of factors, you may be able to determine the severity of mastitis in your herd, which could help improve udder health, milk quality and your bottom line.

Clinical mastitis infection is relatively easy to diagnose with the naked eye; redness or heat from the udder and defects in foremilk such as blood, flakes, clots or a watery appearance are sure signs that the cow has mastitis. However, subclinical mastitis cannot be as easily detected.

A five-year study in Denmark recently analyzed udder health data using eight milk parameters, or defining characteristics. Using these parameters and understanding the conditions that influenced them, the researchers successfully increased their ability to describe and detect subclinical mastitis cases before infections became clinical. The parameters included:

- somatic cell counts (SCC)
- milk yield, measured in kilograms
- electrical conductivity of milk
- component percentages for fat and protein
- lactose and citrate percentages

The results of this study may help producers save money on treatment and reduce milk yield losses.

VARIABLE INFLUENCES

Season and stage of lactation, number of calvings and total mixed ration (TMR) energy density were the strongest variables influencing these milk parameters during the study.

The researchers observed that mastitis was more likely to occur in late lactation if infection was also present early in the lactation. Risk also increased with each lactation. Compared to first calving, mastitis risk was twice as high at second calving, more than two times as high at third, and more than four times as high at fourth.

Feeding combinations also affected the occurrence of clinical mastitis in this study. The researchers found that cows fed a TMR with a low-energy density had the highest cases of clinical mastitis compared to the group on a TMR with high-energy density. This was particularly true beyond second calving and in the early and late stages of lactation.

By taking these variables into account, the Danish study could correct for their influence in a typically healthy udder scenario for each parameter. This adjusted observation was then applied to the different infection levels in the group.

SCCS TELL TALE

Somatic, or white blood, cells increase when an infection is present as part of the cow's immune response system. SCC testing still remains the clearest indication of udder infection. The National Mastitis Council defines subclinical mastitis as a quarter with an SCC of 200,000 or more, with a normal quarter having counts around 100,000. Clinical mastitis is simply a quarter producing abnormal milk, regardless of SCC.

However, the SCC level present in response to an infection from major and minor pathogens hinges on the history of the health of the udder. Major pathogens can induce a more aggressive immune response in the udder — measured as a higher SCC — than minor pathogens for first-time infected udders. If the udder has a history of clinical mastitis in the past, minor pathogens such as

coagulase negative staphylococci can actually produce a higher SCC than *Staphylococcus aureus*. Maintaining a current and detailed treatment record for each animal is essential to assess udder health with each freshening and as lactation progresses.

REDUCED MILK YIELD

One of the most apparent measurements that mastitis can affect is a herd's milk yield. Monitoring each cow's yield lets you know that something may not be right with her udder or overall health if she starts producing less milk.

The study clearly showed that yields dropped significantly — by 15%–18% — as clinical mastitis cases increased. The effect of subclinical mastitis, although not as pronounced, still reduced yields by 5%. Over time, undetected subclinical mastitis can reduce herd production.

Coagulase negative staphylococci, the prevalent mastitis organism in the Danish study, are known to cause mild udder infections. However, persistent infections will significantly affect milk yield. More pathogenic organisms, such as *Staphylococcus aureus*, *Streptococcus agalactiae*, *E. coli* and *Klebsiella* species will produce a more severe response to infection, lowering milk yield much more rapidly than minor pathogens.

Parity also plays a part in how milk yield is affected during infection. Cows that have calved more than once will have higher SCCs and increased yield losses from subclinical mastitis cases. This yield drop also continues as lactation progresses. The loss in yield compared to first calving can be explained by deteriorating udder health from damage due to a history of mastitis from increased exposure to infections.

ELECTRICAL CONDUCTIVITY

Mastitis infections can lead to damage of the mammary gland's outer layer, known as epithelial cells. This damage increases ions such as sodium and chloride released into the mammary gland. They can change the electrical potential of the milk secreted.

Measuring the changes in this electrical potential, or conductivity, of the foremilk can indicate a possible mastitis infection. This provides you with an opportunity to reduce the amount and time of treatment needed.

The Danish study measured the electrical conductivity every 2 seconds during milking, using sensors built into each liner. The researchers concluded that the conductivity increase in the foremilk was directly proportional to the severity of the udder infection.

In a separate study, a group of dairy cows was infected with an environmental mastitis organism, *Streptococcus uberis*. Several animals in the group were allowed to develop clinical mastitis. This resulted in an average treatment period of 10 days to achieve 100% clinical and 94% bacteriological cures.

Electrical conductivity was used to monitor the foremilk from the rest of the group. When abnormal milk was not observed, subclinical cases were predicted if conductivity increased. These cows were then treated with intramammary antibiotics over a period of three days to achieve clinical and bacteriological cure.

This resulted in milk for sale earlier than if the animals had developed clinical signs. Early intervention saved time and money on treatment.

However, electrical conductivity should be used merely as an early warning system that an infection may be occurring, not as a sole indicator for treating a mastitis infection. It's been reported in one study that conductivity was not affected for 50% of cows tested where SCCs rose significantly. Fewer than half the cows that did have a conductivity increase showed an SCC increase.

This shows that electrical conductivity testing can be neither sensitive nor specific. Using it alone could result in missed cases of infection. You might also treat for infection when none was present, losing money from unnecessary antibiotic treatments and withholding milk from the tank during treatment.

Conductivity testing can be an issue with robotic milking systems. Additional tests would be required to confirm mastitis if conductivity levels were to rise.

FAT AND PROTEIN PERCENTAGES

Fat and protein concentrations behaved differently than expected in the study, increasing while the other milk parameters decreased as infection became more severe.

For total protein, the increased concentration could be attributed to the flood of serum proteins entering the milk from the blood, as well as the milk yield decreasing at a faster rate than protein synthesis. On the other hand, casein, another protein, did decrease in concentration as milk yield decreased. The researchers concluded that serum proteins made up for the loss of casein.

Fat concentrations were also more likely to be affected by the slower decrease of fat synthesis during infection when compared to the decrease in milk secretion.

LACTOSE AND CITRATE PERCENTAGES

One of the consequences of an infection in the udder is the breakdown of the barrier between blood and milk. Damage to the epithelial cells in the mammary gland opens up gaps to the blood capillaries between the secretory cells, which make milk.

Citrate and some of the lactose present in the milk will diffuse into these capillaries, decreasing their concentration in the milk. Lactose concentration can also be affected by the impairment of the secretory cells in the udder. As yield decreases, lactose decreases.

By monitoring changes in milk's component percentages, you can gauge the extent of infection and damage to tissue from mastitis. To use these percentages as a monitoring tool for mastitis, keep detailed records of individual milk composition to identify animals that consistently give abnormal component percentages.

RECORDS KEY

The most important factor to keep in mind when using these parameters to predict and describe udder health is accurate records. Since previous infections have a big impact on the future health of a cow's udder, it's imperative to review her history for feeding, parity, milk yield, composition and udder health when making treatment and management decisions based on these parameters.

Overall, the Danish study showed a clear relationship between each of the milk parameters and the status of mastitis and udder health in the herd. These tools may help monitor and predict mastitis early, reduce loss of milk yield, improve herd health and save money.

SOURCES

Biggadike, H.J., I. Ohnstad, R.A. Laven, J.E. Hillerton. Detecting Mastitis Automatically. Proceedings of the British Mastitis Conference 2002, pp. 58–62.

Hillerton, J. Eric, Joanne E. Semmens. Comparison of Treatment of Mastitis by Oxytocin or Antibiotics Following Detection According to Changes in Milk Electrical Conductivity Prior to Visible Signs. Journal of Dairy Science. 82:93–98.

Sloth, K.H.M.N., N.C. Friggens, P. Lovendahl, P.H. Anderson, J. Jensen, K.L. Ingvartsen. Potential for Improving Description of Bovine Udder Health Status by Combined Analysis of Milk Parameters. Journal of Dairy Science. 86:1221–32.

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